Spring 2022 EE214 Experiment 2
Miscellaneous Op-Amp Circuits

Ahmet Akman 2442366
Yusuf Toprak Yıldıran 2444149
Assistant: Onur Selim Kılıç

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Contents

1 Introduction

In this experiment, miscellaneous op-amp circuits and three different setups of op-amp circuity are investigated. First, an independent current source circuit is set, and its behavior is required to be characterized. Then the clipper circuit is constructed, and the output is needed to be observed. Lastly, a negative resistance converter with two zener is built with two different setups. First, its i-v characteristics are expected to be observed; then, a square wave generator is expected to be set.

2 Experimental Results and Discussion

The results of the experiment are discussed in the following steps.

2.1 Step 1

In this step independent current source circuit given in Figure 1 is constructed. A potentiometer with 10KΩ is connected to the one port as R_L.

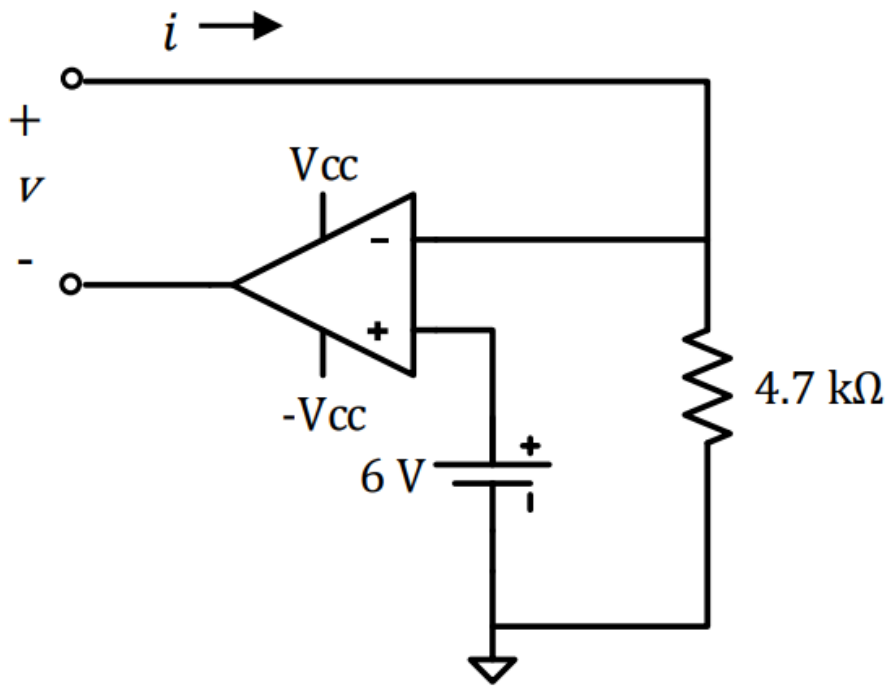

Figure 1: Circuit schematic for the step 1

To be able to obtain the maximum value of the resistance in which the one port still functions as an independent current source, the potentiometer is meticulously adjusted. So, the parameters given in Table 1 are obtained.

Table 1: Liner region boundary parameters

The Current Value	Corresponding Resistance
1.24 mA	8kΩ

As a result, it can be concluded that the independent current source circuit functions as long as it is in the linear region; however when the op-amp saturates, it is no longer works. So, the circuit acts as an independent current source with 1.24mA until the load resistance is 8kΩ.

2.2 Step 2

In this step, the clipper circuitry given in Figure 3 is constructed. V_{in} is set to $3sin(1000\pi t)$ from the signal generator.

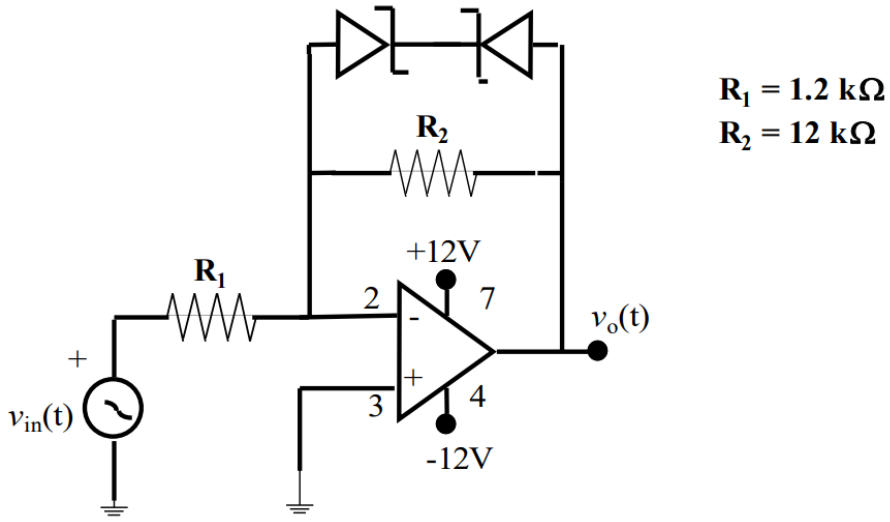

Figure 2: Clipper circuit schematic for the step 2

The plot given in Figure 4 is obtained as a result of V_o vs V_{in}.

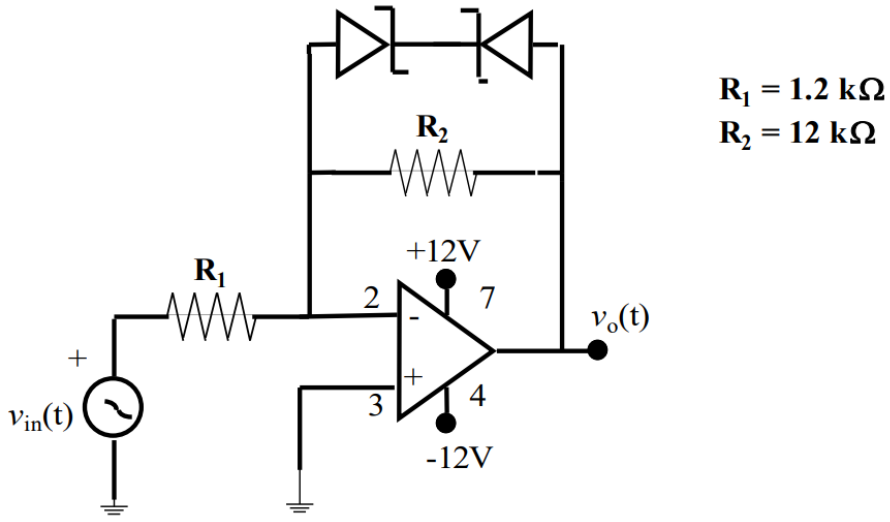

Figure 3: V_o vs V_{in}

So it is observed that saturation voltages are not +12 and -12 Volts. This result is stemmed from the fact that in saturation regions, zener diodes are both open, but one from forwarding and another from the reverse. Which results in the sum of their forward opening

voltage ($\approx$ 1V) and reverse-opening voltage ($\approx$ 6V) to be 7 Volts. In the saturation region, they switch the forward-reverse and results in $\approx 14V V_{pp}$

2.3 Step 3

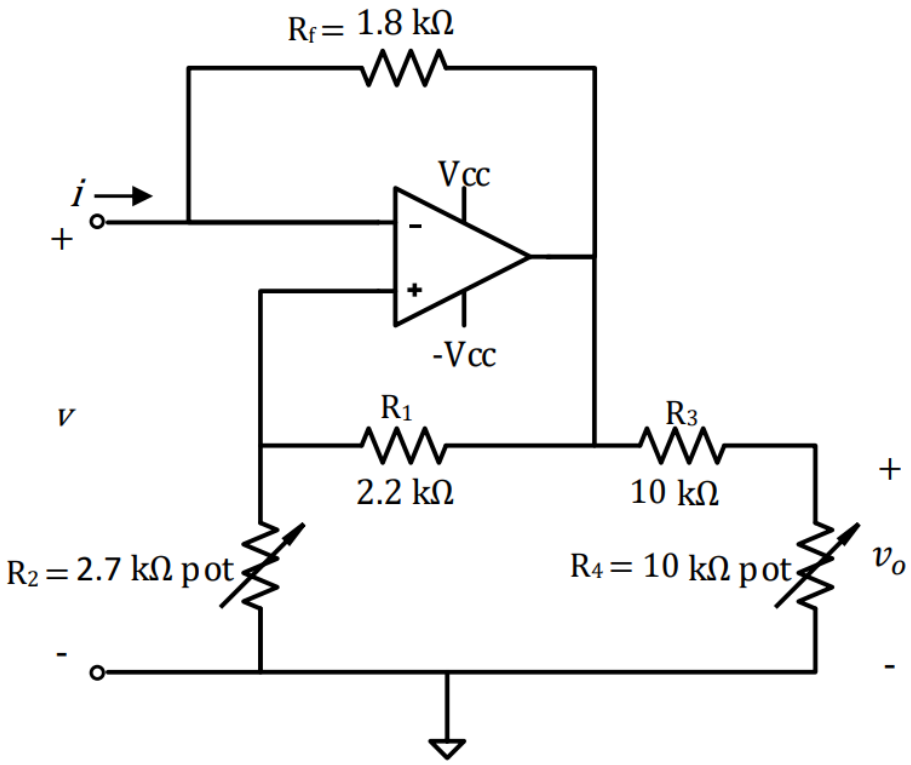

Figure 4: Circuit schematic for the step 3

2.3.1 a)

2.3.2 b)

3 Conclusion

In this experiment, miscellaneous op-amp circuits have experimented with three different op-amp setups: independent current source, clipper, and negative resistance converter. First, it is observed where the independent current source works and the maximum load resistance obtained. Then it is observed that the behavior of the clipper circuit explained the reason why saturation regions are different. Lastly, a negative resistance circuit is constructed. Its one port i-v characteristics are obtained, then a square wave generator is configured with the same setup with the help of a capacitor. The target frequency and amplitude values are achieved, and the variables are noted. To sum up, in this experiment, three different setups of the op-amp are investigated.

Appendix A

- PreLab Preparation 4 hours
- Experimental Work 2 hours
- Report Writing 4 hours